

WHAT IS CLAIMED IS:

1           1. An asynchronous interference avoiding method in a  
2 network, comprising:

3           a first step wherein a slave station, which can  
4 temporarily serve as a master station (a temporary master  
5 station), in a temporary master station interposition-type  
6 network receives a collision control downward packet from a  
7 first temporary master station, which temporarily serves as a  
8 master station, and judges whether or not a unique word for  
9 synchronization contained in the collision control downward  
10 packet is detected;

11           a second step wherein, when the slave station could not  
12 have detected the unique word in the first step as a result of  
13 interference caused by the send of the collision control  
14 downward packet from the first temporary master station and a  
15 second temporary master station as another temporary master  
16 station in different timing, the slave station counts the  
17 number of times of unique word undetection;

18           a third step wherein, when the number of times of receive  
19 of the collision control downward packet and the number of  
20 times of unique word undetection have exceeded or have become  
21 equal to respectively preset thresholds, the slave station  
22 judges, that asynchronous interference with the first temporary  
23 master station has taken place, stops an attempt to synchronize  
24 with the first temporary master station, temporarily functions  
25 as a third temporary master station, and performs send/receive  
26 in slot timing of the third temporary master station;

27 a fourth step wherein the third temporary master station  
28 searches slots in all frequencies being used for a slot, which  
29 exceeds or is equal to a preset threshold and has the highest-  
30 receive field strength, and judges whether or not the slot  
31 meeting the requirements has been detected;

32 a fifth step wherein, when the slot meeting the  
33 requirements has been detected in the fourth step, the third  
34 temporary master station judges that the slot is one in  
35 interference with the first temporary master station, followed  
36 by the send of an interference detection packet through a send  
37 slot corresponding to the detected slot in a continuous manner  
38 by the number of times which exceeds or is equal to a preset  
39 threshold;

40 a sixth step wherein, when the interference detection  
41 packet from the third temporary master station has been sent in  
42 the same timing as the receive slot in the first temporary  
43 master station or the second temporary master station, the  
44 first temporary master station or the second temporary master  
45 station recognizes the receive of the interference detection  
46 packet and hops to a channel, which has been computed using  
47 random numbers, to avoid the interference of the collision  
48 control downward packet; and

49 a seventh step wherein, when the first temporary master  
50 station has hopped to a new channel in the sixth step, the  
51 third temporary master station hops to a channel corresponding  
52 to the channel of the first temporary master station, is  
53 returned in its function to the slave station, and receives the  
54 collision control downward packet from the first temporary

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55 master station.

1           2.    The   asynchronous   interference   avoiding   method  
2   according to claim 1, wherein, in the sixth step,  
3           when the interference detection packet has been sent from  
4   the third temporary master station in timing different from  
5   that in the slot of the first temporary master station and the  
6   second temporary master station, the first temporary master  
7   station and the second temporary master station cannot detect  
8   the unique word and, when the count of the number of times of  
9   unique word undetection has exceeded or has become equal to a  
10   preset threshold within a preset time period, the first  
11   temporary master station and the second temporary master  
12   station each judge that the slot is an interfered one, followed  
13   by hopping to channels which have been computed respectively  
14   using random numbers.

1           3.    The   asynchronous   interference   avoiding   method  
2   according to claim 1 or 2, wherein the fifth step comprises  
3           an eighth step wherein, when the slot meeting the  
4   requirements could not have been detected in the fourth step,  
5   the third temporary master station judges whether or not the  
6   investigation of all the slots has been completed, and, when  
7   the investigation has not been completed, staggers the slot  
8   timing by half cycle, followed by return to the fourth step to  
9   again investigate the receive field strength of all the slots.

1           4.    The   asynchronous   interference   avoiding   method

2 according to any one of claims 1 to 3, wherein, in the eighth  
3 step, when the investigation of all the slots has been  
4 completed, the processing is ended.

1           5.    The asynchronous interference avoiding method  
2   according to any one of claims 1 to 4, wherein the first step  
3   comprises

4 a ninth step wherein, when the first temporary master  
5 station and the second temporary master station each send the  
6 collision control downward packet in a synchronized state  
7 through the same channel, the slave station detects the unique  
8 word and, since the received packet is a packet wherein the  
9 signal of the first temporary master station has been  
10 interfered with the signal of the second temporary master  
11 station, detects an error, and, as soon as the number of times  
12 of receive of the collision control downward packet and the  
13 number of times of packet error detection have exceeded or have  
14 become equal to respective preset thresholds, judges that  
15 interference with the first temporary master station has taken  
16 place, followed by the send of a channel switching request  
17 packet to the first temporary master station and the second  
18 temporary master station, and

19           a tenth step wherein the first temporary master station  
20   and the second temporary master station receive the channel  
21   switching request packet and hop to channels which have been  
22   computed respectively using random numbers.

1            6.    The asynchronous interference avoiding method

2 according to any one of claims 1 to 5, wherein the first step  
3 comprises

4 a step wherein, when the first temporary master station  
5 and the second temporary master station send the collision  
6 control downward packet through respective separate channels,  
7 the slave station detects the unique word and, since no packet  
8 error is detected, judges that the slave station is in  
9 synchronization with the first temporary master station, and  
10 operates according to the operation of ordinary adhoc protocol.

1 7. The asynchronous interference avoiding method  
2 according to any one of claims 1 to 6, wherein, in the third  
3 step, when the number of times of receive of the collision  
4 control downward packet is equal to or less than a preset  
5 threshold, or when the number of times of unique word  
6 undetection is equal to or less than a preset threshold, the  
7 step is returned to the first step.

1 8. The asynchronous interference avoiding method  
2 according to any one of claims 1 to 7, wherein, in the ninth  
3 step, when the number of times of receive of the collision  
4 control downward packet is equal to or less than a preset  
5 threshold, or when the number of times of packet error  
6 detection is equal to or less than a preset threshold, the step  
7 is returned to the first step.

1 9. The asynchronous interference avoiding method  
2 according to any one of claims 1 to 8, wherein

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3 the third step comprises a tenth step wherein, when the  
4 slave station temporarily functions as a third temporary master  
5 station, in all utilizable slots, the interference detection  
6 packet is continuously sent by the number of times which  
7 exceeds or is equal to a preset threshold, and

8 when the tenth step is executed, the processing in the  
9 fourth step and the processing in the fifth step are not  
10 carried out.

1 10. The asynchronous interference avoiding method  
2 according to any one of claims 1 to 9, wherein

3 the fourth step comprises an eleventh step which  
4 comprises: upon the detection of the slot meeting the  
5 requirements, making an examination on whether or not the  
6 unique word is detected; when the unique word has not been  
7 detected, staggering the position of the slot by "1" bit  
8 before; making an examination on whether or not the unique word  
9 is detected; repeating said procedure in a range such that an  
10 electric field can be detected; and, when the unique word has  
11 been detected, sending a channel switching request packet  
12 through a send slot corresponding to said slot to allow the  
13 first temporary master station or the second temporary master  
14 station to perform channel hopping, and

15 when the eleventh step is executed, the processing in the  
16 fifth step is not carried out.

1 11. A storage medium comprising, recorded thereon, a  
2 program which can execute the asynchronous interference

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3 avoiding method according to any one of claims 1 to 10.

1 12. A system for avoiding asynchronous interference in a  
2 network, comprising:

3 a TDMA-TDD processor for performing processing regarding  
4 TDMA-TDD;

5 a clock section for generating a periodic pulse signal  
6 which is sent to an RF section and the TDMA-TDD processor;

7 an adhoc protocol processor for processing a protocol  
8 used in an adhoc network;

9 a storage for the number of receive packets, for counting  
10 and storing received packets;

11 a storage for the number of times of unique word  
12 undetection, for storing the number of times of undetection of  
13 a unique word of a collision control downward packet sent from  
14 a temporary master station of the network;

15 a storage for the number of times of error detection, for  
16 storing the number of times of detection of an error in the  
17 received packet;

18 a hop destination channel computing section which  
19 generates random numbers to compute a channel to which next  
20 hopping is performed; and

21 a plurality of slave stations which can temporarily  
22 perform the operation of the temporary master station, wherein

23 when the TDMA-TDD processor has detected the unique word  
24 for synchronization of the temporary master station with the  
25 slave station, and, when the number of times of receive of the  
26 collision control downward packet in the storage for the number

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27 of receive packets and the number of times of detection of an  
28 error in received packet in the storage for the number of times  
29 of error detection have exceeded or have become equal to  
30 respective preset thresholds, the adhoc protocol processor  
31 judges that interference has taken place between a first  
32 temporary master station and a second temporary master station  
33 as another temporary master station among the temporary master  
34 stations which send information to the slave station, while,  
35 when the TDMA-TDD processor in the slave station cannot detect  
36 the unique word and when the number of times of receive of the  
37 collision control downward packet in the storage for the number  
38 of receive packets and the number of times of unique word  
39 undetection in the storage for the number of times of unique  
40 word undetection have exceeded or have become equal to  
41 respective preset thresholds, the adhoc protocol processor  
42 judges that interference has taken place between the first  
43 temporary master station and the slave station.

44 the TDMA-TDD processor, based on the judgment, made by  
45 the adhoc protocol processor, such that interference has taken  
46 place between the first temporary master station and the second  
47 temporary master station, sends a channel switching request  
48 packet to the first temporary master station and the second  
49 temporary master station through the RF section for performing  
50 the send/receive of radio waves, modulation, and demodulation,  
51 while, based on the judgment, made by the adhoc protocol  
52 processor, such that interference has taken place between the  
53 first temporary master station and the slave station, the slave  
54 station temporarily functions as a third temporary master



55 station which continuously sends, by the preset number of times,  
56 an interference detection packet through a send slot  
57 corresponding to a slot, among slots in all frequencies being  
58 used, which exceeds or is equal to a preset threshold and has  
59 the highest-receive field strength,

60 the hop destination channel computing section, based on  
61 the channel switching request packet received by the first  
62 temporary master station and the second temporary master  
63 station, generates random numbers to compute a channel to which  
64 next hopping is performed, while, in the first temporary master  
65 station or the second temporary master station, upon judgment  
66 on the receive of the interference detection packet, or upon  
67 judgment on undetection of the unique word of the interference  
68 detection packet, or upon judgment of the interference  
69 detection packet as an error packet, in which an error has been  
70 detected, in order to avoid interference, the hop destination  
71 channel computing section generates random numbers to compute a  
72 channel to which next hopping is performed, and

73 the third temporary master station, when the first  
74 temporary master station has performed channel hopping, hops to  
75 a channel corresponding to the channel of the first temporary  
76 master station and then returns in its function to the slave  
77 station to again receive, as the slave station, the collision  
78 control downward packet from the first temporary master station.

1 13. The asynchronous interference avoiding system  
2 according to claim 12, wherein the TDMA-TDD processor  
3 comprises:

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4 a frame processor which transfers, among packets received  
5 from the RF section, only a packet related to the adhoc  
6 protocol processor to the adhoc protocol processor;

7 a slot processor which extracts a receive packet of a  
8 designated slot from a receive bit string received from the RF  
9 section and embeds a send packet received from the frame  
10 processor in a designated slot followed by transfer to the RF  
11 section;

12 a unique word check section which detects the unique word  
13 from the receive packet and notifies the adhoc protocol  
14 processor of the result of whether or not the unique word has  
15 been detected;

16 an error detector which examines whether or not there is  
17 an error in the receive packet, notifies the adhoc protocol  
18 processor of the result of error detection, and, when no error  
19 has been detected, transfers the received packet to the frame  
20 processor and receives a receive packet from the unique word  
21 check section which has detected the unique word; and

22 field strength investigation means for investigating the  
23 receive field strength, and wherein

24 the adhoc protocol processor, every time when the  
25 notification of the undetection of the unique word from the  
26 unique word check section has been received, adds "1" to the  
27 value stored in the storage for the number of times of unique  
28 word undetection and stores the obtained value in the storage  
29 for the number of times of unique word undetection; every time  
30 when the notification of receive packet error from the error  
31 detector has been received, adds "1" to the value stored in the

09879989-061401

32 storage for the number of times of error detection and stores  
33 the obtained value in the storage for the number of times of  
34 error detection; and every time when the notification of unique  
35 word detection or undetection from the unique word check  
36 section has been received, adds "1" to the value stored in the  
37 storage for the number of receive packets and stores the  
38 obtained value in the storage for the number of receive packets.

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